

REMARKS

Introduction

In response to the Office Action dated May 18, 2009, Applicants have amended the specification and claims 13-28. Claims 29-35 have been added. Support for amended claim 13 is found in, for example, pg. 6, lines 30-34 and pg. 10, lines 5-11 of the originally filed specification. Claims 14-20, 22-25, 27, and 28 have been amended editorially. Support for amended claim 21 is found in, for example, pg. 6, lines 30-34 and pg. 14, lines 6-20. Support for amended claim 26 is found in, for example, Table 1, pg. 4, lines 28 - 32; pg. 10, lines 16 - 20; and pg. 14, lines 6-20. Support for new dependent claim 29 is found in, for example, original claim 15. Support for new dependent claim 30 is found in, for example, original claim 18. Support for new dependent claim 31 is found in, for example, original claim 19. Support for new dependent claim 32 is found in, for example, original claim 23. Support for new dependent claim 33 is found in, for example, original claim 24. Support for new dependent claim 34 is found in, for example, original claim 27. Support for new dependent claim 35 is found in, for example, original claim 28.

Care has been taken to avoid the introduction of new matter. In view of the foregoing amendments and the following remarks,

Applicants respectfully submit that all pending claims are in condition for allowance.

Claim Rejections Under 35 U.S.C. § 112

Claims 15-20, 23, 24, and 27 are rejected under 35 U.S.C. § 112, second paragraph, as purportedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention. The Office Action asserts that a broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. The Examiner contends that the phrases "such as" and "preferably" render the limitation indefinite.

Applicants traverse.

Applicants respectfully submit that the rejection is moot in view of the foregoing amendment of claims 15-20, 23, 24, 27, and 28. All occurrences of "such as" and "preferably" have been deleted from the instant claims. New claims 29-35 have been added and include the pertinent limitations of claims 15-20, 23, 24, 27, and 28 and are believed to be in compliance with the requirements of 35 U.S.C. § 112, second paragraph.

Claim Rejection Under 35 U.S.C. § 102

Claims 13, 21-22, and 25-27 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,605,685 to Momose et al. ("Momose").

Applicants traverse.

The Office Action, with respect to claim 13, asserts that Momose discloses a method for preparing a membrane to be assembled in a membrane electrode assembly, comprising the step of swelling an ion-conducting membrane in a liquid containing at least one solvent by controlling the content of the solvent in the ion conducting membrane. The Examiner contends that Momose discloses coating of the ion conducting membrane on both sides with an electrode layer to form a sandwich; and hot-pressing the sandwich.

Momose describes dipping a graft polymer membrane in an aqueous solution of 3% hydrogen peroxide (H₂O₂) containing 4 ppm of Mohr's salt at 70°C leading to a decrease of the mass of the membrane. This process step leads to a decrease of the membrane's weight by 15% (Example II & col. 4, line 38), 10% (Example III & col. 4, line 53), and 3% (Example IV and V & col. 5, lines 30 and 46, respectively).

Momose is *silent* regarding drying the ion-conducting membrane after the swelling step, and subsequently re-swelling the ion-conducting membrane by immersing the ion-conducting membrane in a solvent, as required by amended claim 13. Further, Momose is *silent* regarding drying the ion-conducting membrane, then re-

swelling the ion-conducting membrane by immersing it in a solvent before coating and hot-pressing, as required by amended claim 21.

As anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently (noting that "inherency may not be established by probabilities or possibilities," *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)), in a single prior art reference, *Akzo N.V. v. U.S. Int'l Trade Commission*, 808 F.2d 1471 (Fed. Cir. 1986), based on the forgoing, it is submitted that Momose does not anticipate claims 13 and 21 nor any claim dependent thereon.

As described in the present application as filed, the ion-conducting membrane is dried at a temperature range of 100 to 140°C. The subsequent reswelling will lead to an increase in weight of about 20 mass% of the membrane (see, e.g., pg. 5, lines 30-34; pg. 9, lines 15-33; pg. 13, lines 2-6; and pg. 14, lines 10-12 of the originally filed specification). However, Momose does not disclose or suggest this, and apparently is unaware of the improvement in an increased surface energy and hydrophilic surface provided by the claimed method for preparing a membrane to be assembled in a Membrane Electrode Assembly (MEA). Further, one of ordinary skill in the art would not look to Momose's method for the preparation of a graft polymer membrane to solve a problem related to removing residual solvent and would not have been

motivated to modify Momose's method to include drying the ion-conducting membrane at elevated temperatures.

Claim Rejections Under 35 U.S.C. § 103

Claim 17 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Momose.

Dependent claim 17 is allowable for at least the same reasons as independent claim 13, and further distinguishes the claimed method for preparing a membrane.

Claims 14-16 and 18-20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Momose in view of U.S. Patent No. 5,656,386 to Scherer et al. ("Scherer").

Applicants traverse.

With respect to claim 14, the Office Action admits that Momose is silent as to the membrane being a radiation grafted membrane. The Office Action relies on Scherer in an attempt to cure the admitted deficiencies of Momose. The Office Action asserts that Scherer discloses an electrochemical cell with a radiation grated membrane between the electrodes. The Examiner contends that Scherer teaches a graft level ranging from 10-40%. The Examiner avers that Scherer teaches that the membrane is coating or impregnated with an ionically conducting polymeric phase, such as, Nafion. The Examiner concludes that one of ordinary skill in the art would be motivated to modify the process of Momose with the teaching of Scherer to produce a membrane with long-term stability.

Although not relied upon to do so, Scherer is silent about whether or not the membrane is treated after a sulphonation process and the assembling process. Further, Scherer is silent regarding a hot-pressing step in the assembling process. An important difference between Scherer and the claimed subject matter is that the claimed membrane is dried at elevated temperatures, typically 100 to 140 °C. Thus, Scherer fails to cure the deficiencies of Momose.

An aspect of the present invention includes removing residual solvent and transforming the ionomers into an insoluble solid before the dried membrane was re-swollen by immersing the sample in a solvent agent, such as, water. The drying step that occurs before the pre-swelling is prior to the hot-pressing process (see, e.g., pg. 6, lines 30 to 34; pg. 9, lines 15 to 25; and pg. 13, lines 2 to 6 of the originally filed specification). The re-swelling is used to achieve a water swelling of about 20 mass% in order to provide an increased surface energy and an increased hydrophilic surface during the MEA assembly process (see, e.g., pg. 9, lines 27 to 33; pg. 12, lines 14 to 19, pg. 13, lines 2 to 6; and pg. 14, lines 10 to 12 of the originally filed specification)

According to the present invention, the ionomer is placed on the grafted membrane and transformed to an insoluble solid with the facilitation of an additional swelling step (re-swelling) prior to the hot-pressing. Both the solidified ionomers on the

grafted surface of the membrane and the re-swelling of the membrane prior to the hot-pressing step are distinguishable over the cited prior art. However, Scherer does not disclose or suggest this, and apparently is unaware of the improvement in an increased surface energy and hydrophilic surface provided by the claimed method for preparing a membrane to be assembled in a MEA.

As Momose and Scherer do not disclose the same method for preparing a membrane and method for manufacturing a MEA as disclosed by the present inventors, and even if combined still fail to disclose or suggest the elements recited by amended claims 13 and 21, the combination of Momose and Scherer does not render the method as recited by amended claims 13 and 21 obvious.

Claims 23, 24, and 28 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Momose in view of Pre-Grant Pub. No. 2004/0115499 to Tani et al. ("Tani").

The Office Action admits that Momose is silent regarding the electrode layer being selected from carbon cloth, paper, or felt. The Office Action relies on Tani in an attempt to cure the admitted deficiencies of Momose. Although not relied upon to do so, Tani fails to disclose or suggest drying the ion-conducting membrane at elevated temperatures, typically 100 to 140 °C, as required by amended claims 13 and 21. Thus, Tani does not cure the deficiencies of Momose.

Withdrawal of the foregoing rejections is respectfully requested.

New Claims

New dependent claim 29, for example, recites, "...the graft level is in the range of 10 to 40 mol%." Nothing in the cited prior art teaches or suggests the described subject matter. Additionally, dependent claims 30-35 recite patentably distinguishing features of their own. It is submitted that these new claims distinguish over the cited prior art.

Conclusion

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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